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ANISIAN AMMONOIDS FROM MALAYA

By BERNHARD KUMMEL

Fossiliferous marine strata are sparsely represented or known from Malaya. Even the Triassic system which is one of the better known systems to yield fossils is represented by extremely small faunas consisting mainly of pelecypods, and only indeterminate ammonoids have been reported by Newton (1923, 1925). The first discovery of determinable ammonoids was reported by Savage (1950) from mudstones near Kuala Lipis, Pahang. The initial collections were submitted to L. F. Spath of the British Museum (Natural History) who made the following report (in Savage, 1950): "Quite a number of common Middle Triassic (Anisian) genera can be recognized in the collection, including *Paracerasites* (dominant), *Sturia*, *Ptychites*, and *Acrochordiceras*, so that the age of the assemblage is the *trinodosus* zone. Specific identifications would be more difficult but are unnecessary: *Paracerasites trinodosus* (Mojsisovics) and such close allies as the Himalayan *Cerasites thuilleri* (Oppel) and *P. winterbottomi* (Salter) are probably all represented."

The rarity of Triassic ammonoids in Southeast Asia, lying as it does at the eastern end of Tethys between the richly fossiliferous Triassic horizons of the Himalayas and the island of Timor, warrants a more substantial record of these faunas than Spath was able to give. Through the kindness of Dr. M. K. Howarth of the British Museum (Natural History) all of the best preserved material from Kuala Lipis, Pahang, was loaned to the writer. Close examination of this small collection (29 specimens) showed that Spath's conclusions as to genera present and age assignment are correct in spite of the rather poor preservation.

The fauna contains the following species :

Paraceratites trinodosus (Mojsisovics)

Sturia sansovinii Mojsisovics

Acrochordiceras sp. indet.

Ptychites sp. indet.

Data on the geographic and geologic occurrence of this fauna can best be quoted from Savage (1950, p. 76) : "One of the newly recorded areas is some 10.5 miles south-south-west of Kuala Lipis on one of the branches of the Sungei (= River) Tua, where it flows through Budu Estate (approximately lat. N. $4^{\circ}02'30''$, long. E. $102^{\circ}00'15''$; Malayan Survey Department Topographical Sheet No. 2 0/13). The rocks are mudstones, rarely laminated sufficiently to be called shales. They are fairly homogeneous, slate grey, almost black and carbonaceous; but some slightly sandier strata (muddy siltstones) weather to a pale buff or brown. The beds show minor flexures but in the main strike 40° - 220° and dip to the north-west at angles of about 40° . They are strongly jointed along several directions, the two main joint systems being vertical and striking 60° - 240° and 155° - 335° . The beds are fossiliferous over a distance of at least 50 yds. in a horizontal direction normal to the strike, equivalent to a stratigraphical thickness of about 100 ft." No data are available with the specimens as to their precise position in the fossiliferous horizon.

The species recognized in this small fauna are common forms widely distributed in Tethys and the general circum-Pacific region. *Paraceratites trinodosus* and *Sturia sansovinii* were originally established on Alpine specimens. The specimens assigned to *Ptychites* and *Acrochordiceras* are too poorly preserved to enable specific identification but there is no doubt as to the generic assignment.

The two previous records of Triassic ammonoids from Malaya are not as satisfactory. A small fragment of an ammonoid was recorded by Newton (1923, p. 302, pl. 9, fig. 29); it is quite indeterminable. The specimen came from argillaceous sandstone at Mount Faber, Singapore, and was reported to have a "depressed whorl with indications of straight ribs and furrows connecting with some well-separated knob-like tubercles situated within a short distance of the inner margin." Newton likewise

did not believe the specimen was determinable but thought that it resembled the genus *Balatonites*. There does not appear to be any justification for this suggestion. The second record of ammonoid remains from Malaya is also in a paper by Newton (1925) on a small Upper Triassic fauna from the Province of Kedah. The first of the two specimens available to Newton was cited as *Ammonites* sp. indet. "A" and he suggested that it may be referred to a form of the Arcestidae. It seems more likely that it is a *Juvavites* or possibly an *Anatolites* but the specimen lacks the characteristic constrictions of these genera (Spath, 1951, p. 106, footnote). The second specimen was listed by Newton as *Ammonites* sp. indet. "B" and suggested a resemblance to *Balatonites*. Spath (1951, p. 15) thought that this specimen might be *Hannoceras nasturtium* (Mojsisovics).

In the adjoining regions of southeast Asia only Indochina has yielded a large and varied fauna of Triassic ammonoids which, however, are generally not well preserved. The literature on the stratigraphy and faunas of this area is very large and need not be reviewed here. A brief summary can be found in Saurin (1956). The only other really new discovery of Triassic ammonoids in southeast Asia has been made in Thailand where Anisian and Karnian faunas are now known. The geology of this Triassic region has been described by Pitakpaivan (1955) who includes a preliminary list of the species present, identified by Kummel. Full description of this fauna will be published shortly.

In the following description of the species from Kuala Lipis the extensive synonymies for *Paraceratites trinodosus* and *Sturia sansovinii* have been omitted; essentially complete synonymies can be found in Diener (1915a) and Kutassy (1933).

SYSTEMATIC DESCRIPTIONS

Family CERATITIDAE Mojsisovics, 1879

Genus PARACERATITES Hyatt, 1900

PARACERATITES TRINODOSUS (Mojsisovics)

Plate 1, figures 3-6

The collection contains no less than twenty crushed and incomplete specimens that can be assigned to the well known

Paracratites trinodosus (Mojsisovics). Allowing for the general faulty preservation, these specimens agree well in most details with the type of this species and with other specimens assigned to it. In his preliminary examination of the fauna, Spath (in Savage, 1950, p. 76) considered that in addition to *Paracratites trinodosus* the fauna also contained *P. thuilleri* (Oppel) and *P. winterbottomi* (Salter). These are very closely allied forms occurring with *P. trinodosus* in the Himalayas. However, considering the poor preservation of the specimens, it seems that a more conservative approach is desirable and I am recognizing only the better known and more widely distributed *P. trinodosus*.

This species is particularly widespread in the Alps, Balkans and the Middle East. It is likewise recorded from the Himalayas and Nevada. Identical or closely related species are also known from Japan. This species gives its name to the upper Anisian *trinodosus* zone.

Repository. BMNH — C 55672, C 55673, C 55674, C 55675 (figured specimens); C 55653, C 55654, C 55655, C 55657, C 55658, C 55661, C 55662, C 55663, C 55666, C 55667, C 55668, C 55670, C 55671, C 55676, C 55678.

Family PTYCHITIDAE Mojsisovics, 1882

Genus PTYCHITITES Mojsisovics, 1875

PTYCHITES sp. indet.

Plate 1, figure 7

The collection contains three crushed and fragmentary specimens that without question belong in *Ptychites* but identification at the specific level is not possible nor advisable. The most complete specimen is actually only the impression of one side of a conch. The illustration on Plate 1, figure 7 is of a latex cast of this impression. It shows the funnel-shaped umbilicus, broadly arched lateral areas, and the radial ribs — all features which are very characteristic of the genus *Ptychites*.

Ptychites is known from Middle Triassic strata throughout the world. It likewise includes a very large number of species based largely on differences in shape of the conch, character of ribs, degree of involution, and details of the suture. In the Himalayan

Muschelkalk, *Ptychites*, of the group of *P. rugiferus* (Oppel) to which these Malayan specimens most likely belong, is one of the most abundant forms present, being represented by seven species (Diener, 1895, 1907). In southeast Asia the record of *Ptychites* is very fragmentary and represented mostly by indeterminate species. Even the rich Middle Triassic faunas of Timor appear to have only one species, *P. amarassicus* Welter (1915; Arthaber, 1928). The genus is, however, also present in Thailand and Indochina. It is also known to be present in Japan and New Zealand.

Repository: BMNH — C 55659 (figured specimen); C 55664, C 55656.

Genus STURIA Mojsisovics, 1882

STURIA SANSOVINII Mojsisovics

Plate 1, figure 2

The most easily recognizable species in the collection is this strigate form which is widely distributed throughout Tethys. The specimen consists only of the impression of slightly more than one third volution of one side of a whorl; no suture or whorl section is preserved. In spite of this fragmentary preservation the ornamentation is so characteristic that there is no reason to doubt its identity with this species. The ornamentation consists of broad, flattened strigations separated by broader, rounded grooves which bear a fine spiral line down the center. The pattern of ornamentation on the Malayan specimen is identical to the fine specimen from the Shalshal Cliffs in the Himalayas, figured and described by Diener (1895, pp. 61-62, pl. 15, figs. 1a, b). In his description of the Himalayan specimen Diener was quite emphatic as to the identity of his form with the type from the Alpine Middle Triassic. In this conclusion he had confirmation from Mojsisovics who also examined the Himalayan specimen.

Sturia sansovinii is known from Anisian and Ladinian strata at many localities in the Mediterranean region. Bibliographic citations to these can be found in Diener (1915a) and Kutassy (1933). The distribution in the region of eastern Tethys and in the circum-Pacific region is not so well known and is of special

interest here. This species is the only form of *Sturia* from the Himalayas proper in the so-called Himalayan facies, where Diener (1895, 1907) has recorded specimens from the upper Muschelkalk at the Shalshal Cliff and at Spiti. However, in Tibet in some of the exotic blocks of Malla Johar near Chitichun Peak No. 1 (17,740 ft.), Diener obtained a specimen of *Sturia* which he identified as *Sturia mongolica* (Diener, 1895, p. 113, pl. 29, fig. 4). This form is quite distinct from other species of *Sturia* in its open umbilicus and the suture, characterized by long, slender, pyramidal saddles. At a later date Diener (1916) erected the genus *Psilosturia* with *S. mongolica* as the type species.

Indeterminate species have been recorded from Middle Triassic horizons in upper Thailand (Kummel, in Pitakpaivan, 1955). These particular forms are small, poorly preserved, and crushed specimens whose relationship to *S. sansovinii* is impossible to determine. Among the numerous Middle Triassic faunas described from Indochina, *Sturia* has as yet not been recorded. Welter (1915) records *S. cf. sansovinii* from a Ladinian horizon on Timor based on a fragmentary specimen.

Sturia japonica Diener (1915b, pp. 18-20, pl. 6, figs. 1-2) is based on a highly distorted specimen from Middle Triassic formations at Inai, Japan. It is quite similar to *S. sansovinii* differing in minor features of the suture and character of the strigations.

Sturia sansovinii is thus found widely distributed throughout the Tethyan geosyncline where it occurs in strata of Anisian and Ladinian age.

Repository: BMNH — C 55669 (figured specimen).

Family ACROCHORDICERATIDAE Arthaber, 1911

Genus ACROCHORDICERAS Hyatt, 1877

ACROCHORDICERAS sp. indet.

Plate 1, figure 1

A single, large, crushed and elongated specimen can be assigned to the genus *Acrochordiceras* but its poor and incomplete preservation prevents determination of its specific relationship. The whorl sides bear strong radial to slightly curved sharp ribs.

Some of the ribs begin at the umbilical shoulders where they increase in height forming somewhat of a tubercle beyond which they bifurcate. Other ribs lack the umbilical protuberances and are slightly less prominent. The poor preservation prevents determining the pattern of alternation of these two types of ribs. The conch was no doubt slightly evolute but the shape of the whorl section is not possible to determine nor is any part of the suture preserved.

Close comparison of this Malayan specimen with the known species of *Acrochordiceras* is not very satisfactory but one feature is notable — that is, the rather sharp ribs on the Malayan form. The extent to which these sharp ribs may be due to the deformation of the specimen is hard to determine, however. In most species of *Acrochordiceras* the ribs tend to be rounded and in some cases broadly rounded. Even though specific comparisons are not possible there is no question of the generic assignment of this form.

The genus *Acrochordiceras* is widely distributed in the Tethyan belt from the Alps to Timor and is likewise known from a number of localities in the circum-Pacific region.

Repository. BMNH — C 55660 (figured specimen).

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Explanation of PLATE

The specimens illustrated on this plate are from mudstones of Anisian age from near Kuala Lipis, Pahang, Malaya. They are deposited in the British Museum (Natural History), London.

Figure 1. *Aerochordiceras* sp. indet. BMNH — C 55660. X 0.5.

Figure 2. *Sturia sansovinii* Mojsisovics. BMNH — C 55669. X 0.5.

Figure 3-6. *Paraceratites trinodosus* (Mojsisovics) BMNH — C 55672 — C 55675. X 1.

Figure 7. *Ptychites* sp. indet. BMNH — C 55659. X 1.